v_2 of the J/$\psi \rightarrow \mu^+\mu^-$ using the "subtraction method"

Catherine Silvestre

PWG: Heavy Light
Run-7 Au+Au, $\sqrt{s} = 200$ GeV
AN 669

Plenary session

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Pt integrated [0,5]GeV/c

opposite RxnP

centrality	p_T	v_2^{true}(south)	v_2^{true}(north)	v_2^{true}(average)
[20, 40]	[0, 5]	$0.16 \pm 0.112 \pm 0.007$	$-0.14 \pm 0.150 \pm 0.006$	$0.03 \pm 0.089 \pm 0.001$
[40, 60]	[0, 5]	$0.35 \pm 0.153 \pm 0.011$	$-0.01 \pm 0.164 \pm 0.000$	$0.18 \pm 0.108 \pm 0.004$
[20, 60]	[0, 5]	$0.20 \pm 0.091 \pm 0.009$	$-0.11 \pm 0.117 \pm 0.005$	$0.06 \pm 0.072 \pm 0.002$

Difference North South larger than 2σ...

both RxnP

centrality	p_T	v_2^{true}(south)	v_2^{true}(north)	v_2^{true}(average)
[20, 40]	[0, 5]	$0.17 \pm 0.088 \pm 0.007$	$-0.07 \pm 0.126 \pm 0.003$	$0.08 \pm 0.072 \pm 0.003$
[40, 60]	[0, 5]	$0.30 \pm 0.140 \pm 0.010$	$0.04 \pm 0.112 \pm 0.001$	$0.15 \pm 0.085 \pm 0.005$
[20, 60]	[0, 5]	$0.20 \pm 0.072 \pm 0.009$	$-0.03 \pm 0.094 \pm 0.001$	$0.10 \pm 0.058 \pm 0.004$

same RxnP

centrality	p_T	v_2^{true}(south)	v_2^{true}(north)	v_2^{true}(average)
[20, 40]	[0, 5]	$0.03 \pm 0.106 \pm 0.001$	$0.03 \pm 0.158 \pm 0.001$	$0.02 \pm 0.089 \pm 0.001$
[40, 60]	[0, 5]	$0.09 \pm 0.157 \pm 0.003$	$0.02 \pm 0.157 \pm 0.001$	$0.06 \pm 0.111 \pm 0.001$
[20, 60]	[0, 5]	$0.05 \pm 0.094 \pm 0.002$	$0.03 \pm 0.123 \pm 0.001$	$0.04 \pm 0.075 \pm 0.001$

North and South are compatible.

Pt integrated [1,5]GeV/c

opposite RxnP

centrality	p_T	v_2^{true}(south)	v_2^{true}(north)	v_2^{true}(average)
[20, 40]	[1, 5]	$0.19 \pm 0.109 \pm 0.008$	$-0.19 \pm 0.176 \pm 0.008$	$0.07 \pm 0.092 \pm 0.002$
[40, 60]	[1, 5]	$0.35 \pm 0.167 \pm 0.011$	$-0.04 \pm 0.178 \pm 0.001$	$0.14 \pm 0.124 \pm 0.003$
[20, 60]	[1, 5]	$0.23 \pm 0.078 \pm 0.010$	$-0.16 \pm 0.137 \pm 0.007$	$0.16 \pm 0.066 \pm 0.005$

Difference North South even worse...

both RxnP

centrality	p_T	v_2^{true}(south)	v_2^{true}(north)	v_2^{true}(average)
[20, 40]	[1, 5]	$0.23 \pm 0.099 \pm 0.010$	$-0.20 \pm 0.142 \pm 0.008$	$0.04 \pm 0.083 \pm 0.002$
[40, 60]	[1, 5]	$0.32 \pm 0.123 \pm 0.010$	$0.10 \pm 0.130 \pm 0.003$	$0.21 \pm 0.090 \pm 0.007$
[20, 60]	[1, 5]	$0.26 \pm 0.076 \pm 0.012$	$-0.12 \pm 0.113 \pm 0.005$	$0.09 \pm 0.065 \pm 0.004$

same RxnP

centrality	p_T	v_2^{true}(south)	v_2^{true}(north)	v_2^{true}(average)
[20, 40]	[1, 5]	$0.13 \pm 0.103 \pm 0.005$	$-0.01 \pm 0.173 \pm 0.000$	$0.04 \pm 0.091 \pm 0.001$
[40, 60]	[1, 5]	$0.23 \pm 0.162 \pm 0.007$	$-0.00 \pm 0.175 \pm 0.000$	$0.10 \pm 0.120 \pm 0.002$
[20, 60]	[1, 5]	$0.14 \pm 0.091 \pm 0.006$	$-0.02 \pm 0.137 \pm 0.001$	$0.04 \pm 0.077 \pm 0.001$

Discussion

Comments

- As expected (knowing v_2 for [0,1]GeV/c) the difference North / South doesn't fade away (on the contrary) when integrated over [1,5]GeV/c instead of [1,5]GeV/c

What has been double/tripple checked:

- Signal is good enough in the pt-integrated bins
- There is no bug when summing the bins, when fitting, nor when accessing the RxnP information
- However if you look at the yields vs. ϕ-ψ in North arm and the resulting fits, it has the opposite shape to what is expected ($v_2 > 0$) and differente from what's going on for South arm (which is physically not possible)

Lets have a look at the yields in 6 bins in ϕ-ψ between [-π,π]

[20,40%] [1,5]GeV/c opposite Rxnp
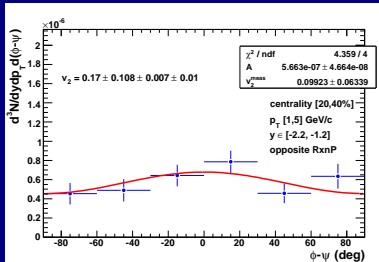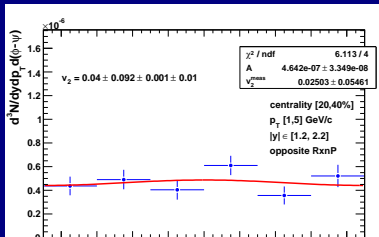
South
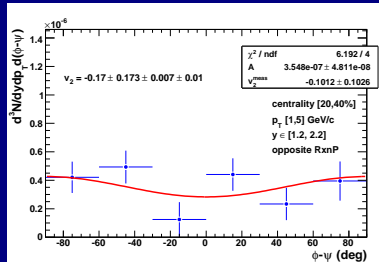
North

Average

South arm look good, match the $cos2(\phi - \psi)$ function.
North look so weird...
Still, v_2 are compatible between arms within errors...

[40,60%] [1,5]GeV/c opposite Rxnp

South
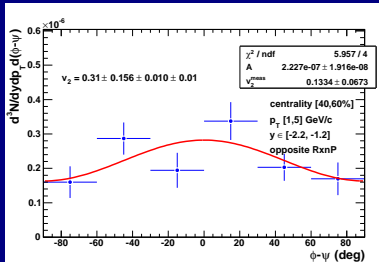
North

Average
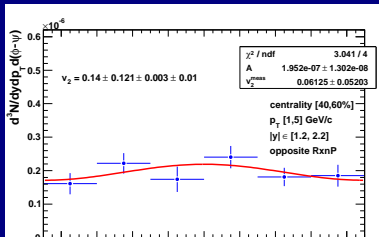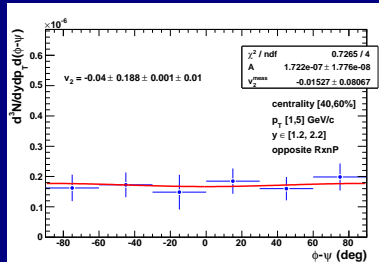
same patern as previous centrality bin.

Discussion

North arm...

- The yields should have about the same amplitude symetrically around 0. This is not the case for North arm... where points seem more close for bins 3 and 5, and 2 and 4 than 3 and 4, and 2 and 5... Do we have a shift ? What's going on ?

- One could think that it's because the mass fits are worse since there is less signal:

~silvestr/afs/muons/source/DimuonMixer/macros/v2_macros/postscripts/v2/signal/

signal_oppositeRxnp_cent4-12_pt4-20_ncent3_pt1_phi6.ps

- However the error propagation should account for it and thus, the v2 integrated over p_T should be the same as when there is more signal (like when looking at 3 bins between $[0,\pi]$) in the end.

- This is the case : the v_2 final values between 3 and 6 bins are very close.

- This also confirms that the summing of the ϕ-ψ bins is done properly.

Lets have a look at the different RxNP configuration and the shape of the fit
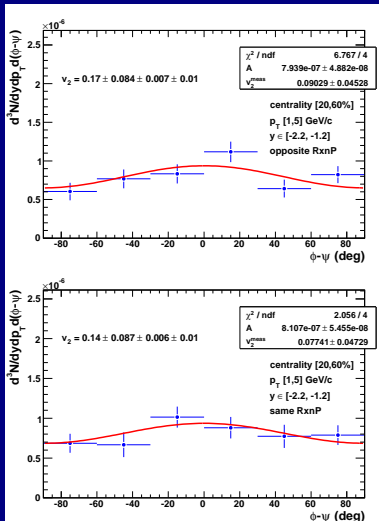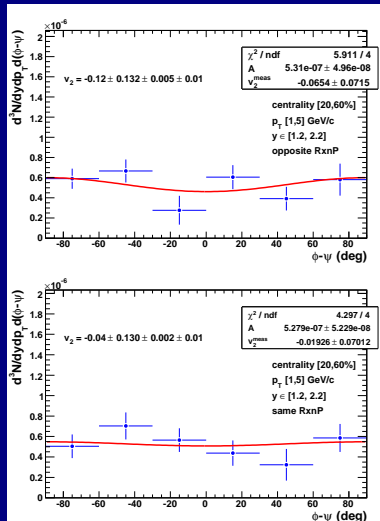
South

North

Discussion

Bias from one RxnP?

- If the issue was the RxnP detector we are using, than the north arm yields should behaved better for either the opposite or the same configuration (and oppositly for South arm).

- This doesn't seem to be the case and only North yields do not follow the $cos2(\phi - \psi)$ fit.

I include all plots of [1,5]GeV/c and 6 phi bins in the following slides. You can find other plots here:
/afs/rhic.bnl.gov/phenix/users/silvestr/muons/source/DimuonMixer/macros/v2_macros/postscripts/v2/

If anyone has ideas about things we could do to understand better, please brainstrom !

It's hard to beleive the North arm points are correct as they are... this is not physical.

[20,40%] [1,5]GeV/c both Rxnp
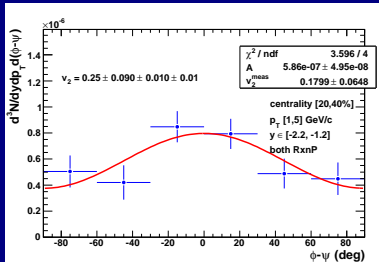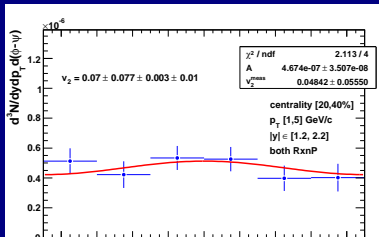
South
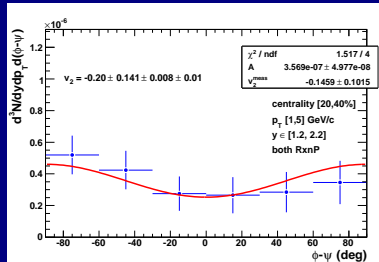
North

Average

South and North arm should behave the same way since it's the same physics...

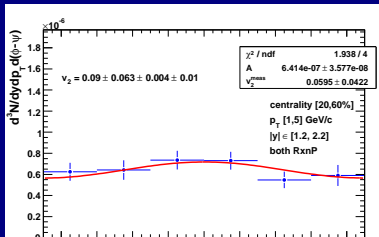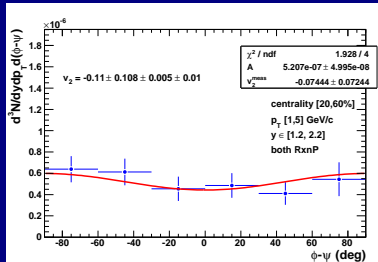# [40,60%] [1,5]GeV/c both Rxnp
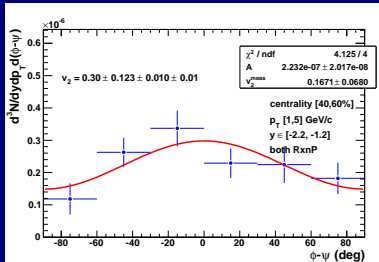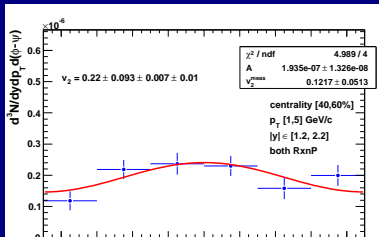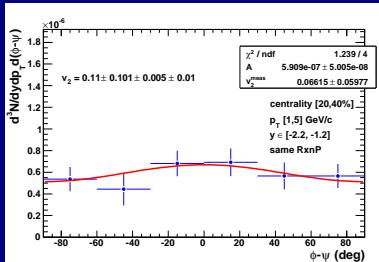
South
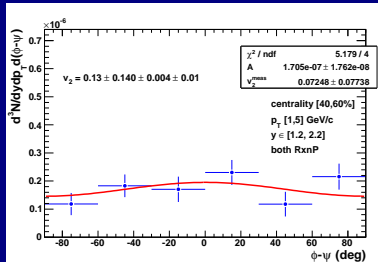
North

Average

[20,60%] [1,5]GeV/c both Rxnp

South

North

Average

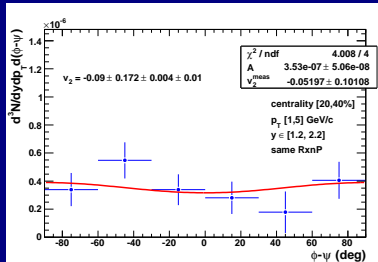# [20,40%] [1,5]GeV/c same Rxnp

South
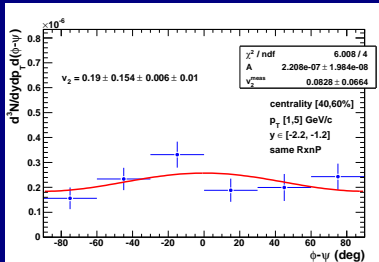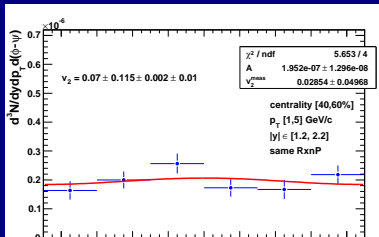

North

Average

[40,60%] [1,5]GeV/c same Rxnp

South

North

Average

[20,60%] [1,5]GeV/c same RxnP

South

North

Average